Effectiveness of Remediation in the Cochato River, Baird & McGuire Superfund Site

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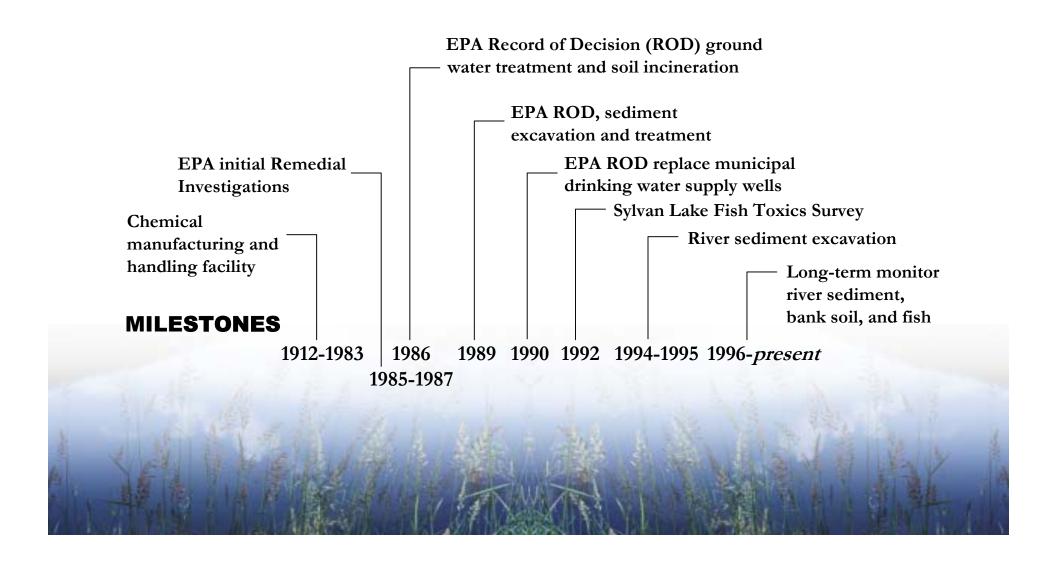


Presentation Overview

- Site History and Background
- Long-Term Monitoring Program
 - Objectives
 - Stations Monitored
 - Parameters Monitored
- Results of Monitoring
 - Fish
 - Sediment and River Bank Soil
- Summary and Conclusions



Baird & McGuire Site History





Long-Term Monitoring Program Asks the Following Questions

- Are Concentrations of COCs in Fish Fillets Below Project Action Limits (PALs)?
- Are Concentrations in Sediment and River Bank Soil Below PALs?
- Are Time Trends Apparent, and if so, in Which Medium and Where?
- Are Concentrations Overall Increasing or Decreasing?



Monitoring Stations in the Cochato River

Listed Up to Downstream:

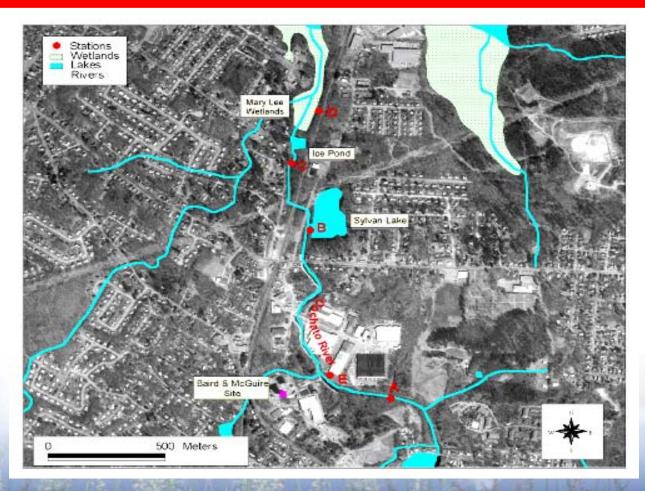
Station A - Control location upstream and outside the influence of the Site

Station E - Adjacent to the Site (area of excavation)

Station B - Between Union and Center Streets

Station C - Ice Pond reach of the River

Station D - Mary Lee Wetlands reach





Cochato River On Site and Downstream 4-Years Post-Remediation



Station E, adjacent to the Site area of excavation in the River (Battelle, 1999)



Station B, 400-meters downstream of the Site and excavation (Battelle, 1999)



Long-Term Monitoring Program Measurement Parameters 1988-2000

Parameter	1988	1992	1996	1997	1998	1999	2000
Sediment/Soil Chemistry							
Arsenic	X		X	X	X	X	X
Chlorinated Pesticides and PAHs	X		X	X	X	X	X
Tissue Chemistry							
Arsenic		X					
Chlorinated Pesticides and* PAHs		X	X			X*	X*
PCB		X					
Dioxin/Furans		X					
Ancillary Measurements							
Grain Size (sediment/soil)	X		_	X	X	X	X
TOC (sediment/soil)	X		X	X	X	X	X
% Lipid (tissue) and Fish Aging		X		- a	3 -	X	X



Species, Ages and Sample Size of Fish Fillets in 1999 for Tissue Chemistry

Parameter		Station and Species								
	Units	A		В	C	C D Sylvan Lake		(SL) Program Year		
		PS	RP	BG	BG	RP	BB	BB	СР	
Approximate Age ^a	Year	3 - 4	3 - 6	2 - 4	2 - 5	2-4	NA	NA	8	1999
Sample Size b	N	8	4	14	8	8	1	1	1	1999

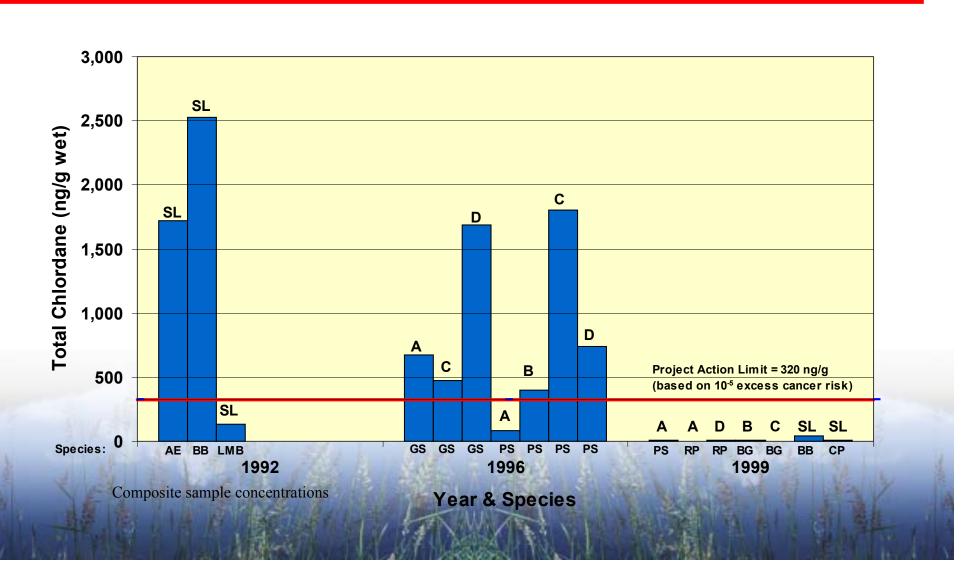
BB – brown bullhead; BG – bluegill; CP – chain pickeral; PS – pumpkinseed; RP – redfin pickeral NA – Not applicable/available because age analysis not performed on brown bullhead.

^a Fish aged using fish scale analysis for individual fish used in composite fillets.

^b Age analysis on a total of 43 fish that produced 17 composite fillets for tissue chemistry.

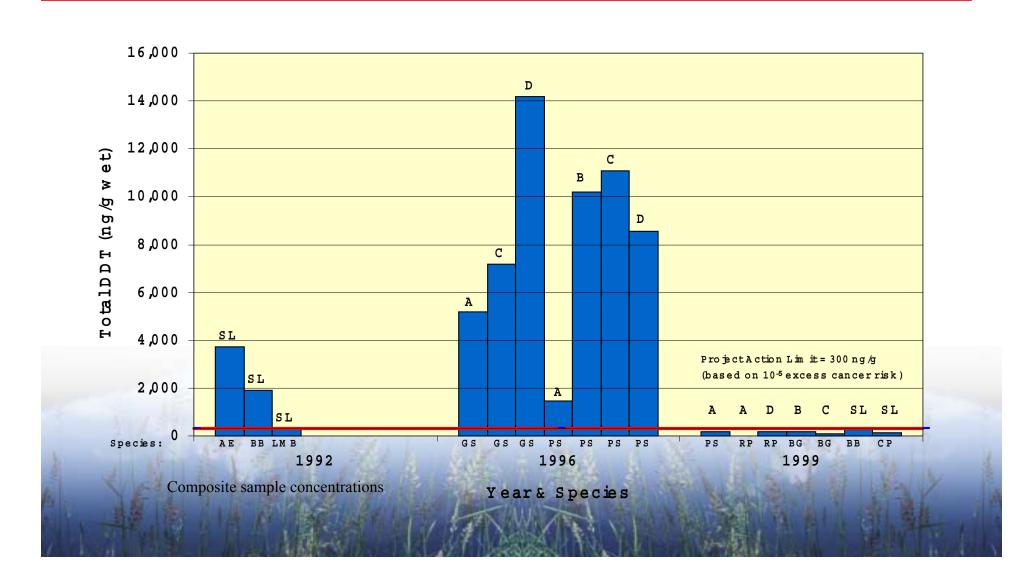


Total Chlordane in Fish Fillet, 1992-1999



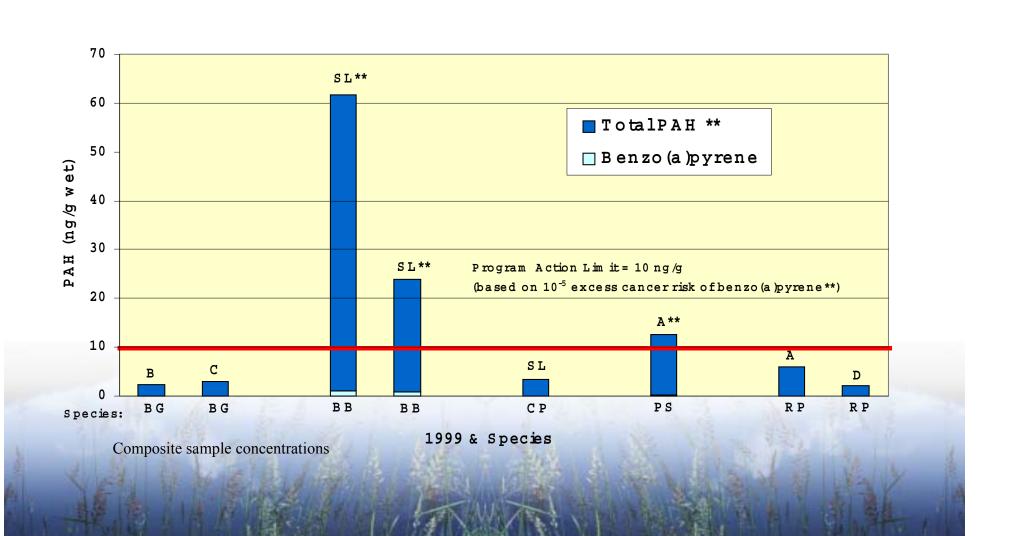


Total DDT in Fish Fillet, 1992-1999





PAH in Fish Fillet, 1999





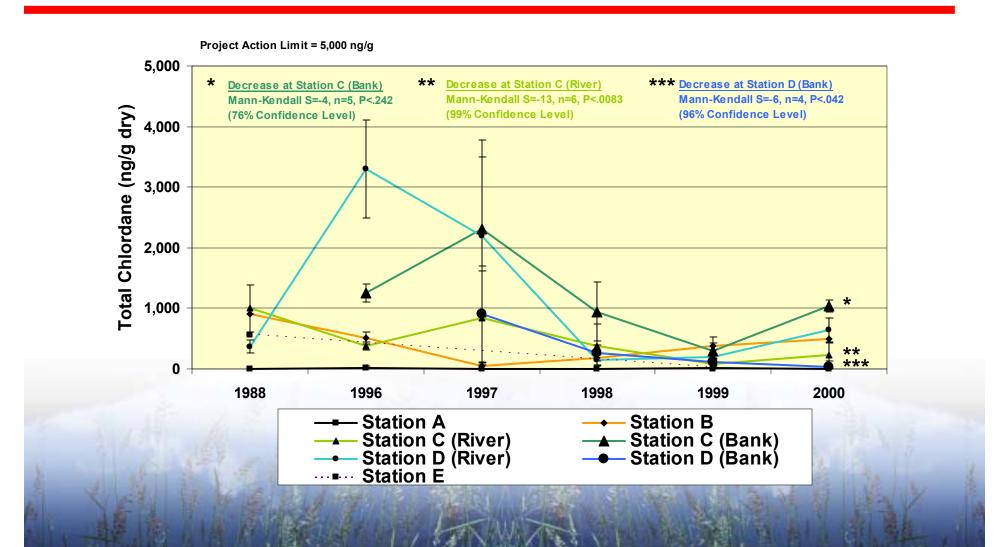
Overall Trends in Fish Contamination 1992-1999 or 1996-1999^a

Station	Station Description	Total DDT	Total Chlordane	Total PAH
Station A	Control	\	\	No Trend
Station E	Adjacent to the Site	No Sample	No Sample	No Sample
Station B	Between Union and Center Streets	\	\	No Trend
SL	Sylvan Lake	\	\	No Trend
Station C	Ice Pond	\	\	No Trend
Station D	Mary Lee Wetlands	\	\	No Trend

^a Decreases in 1996-1999 fish from Stations A-D, and 1992-1999 fish from Sylvan Lake

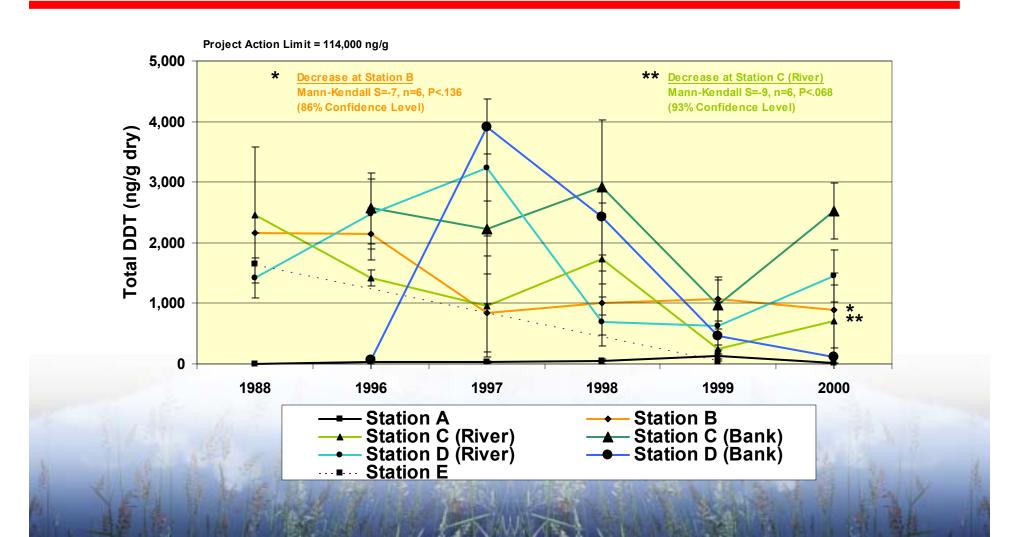


Mean Total Chlordane in Sediment and River Bank Soil, 1988-2000



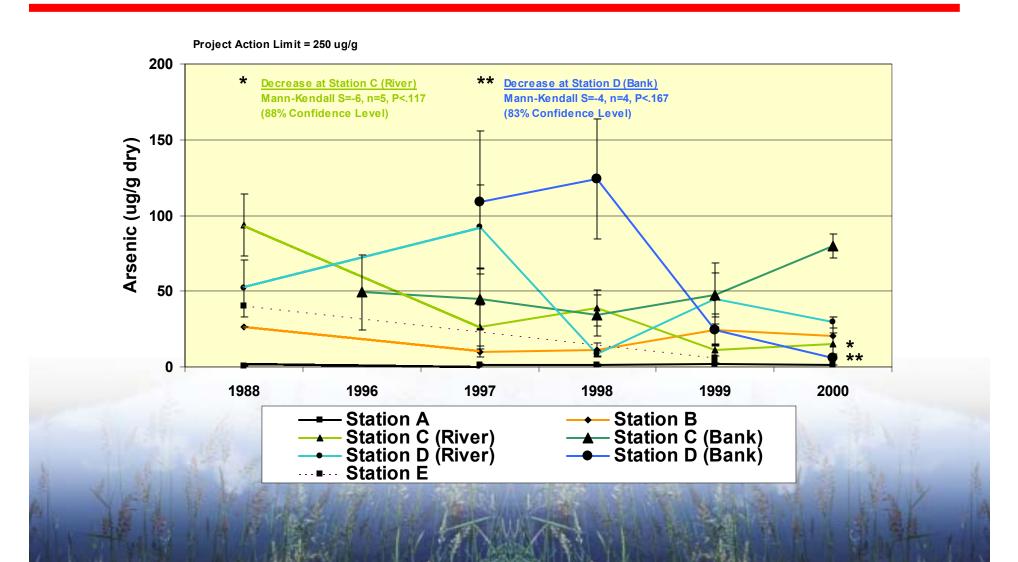


Mean Total DDT in Sediment and River Bank Soil, 1988-2000



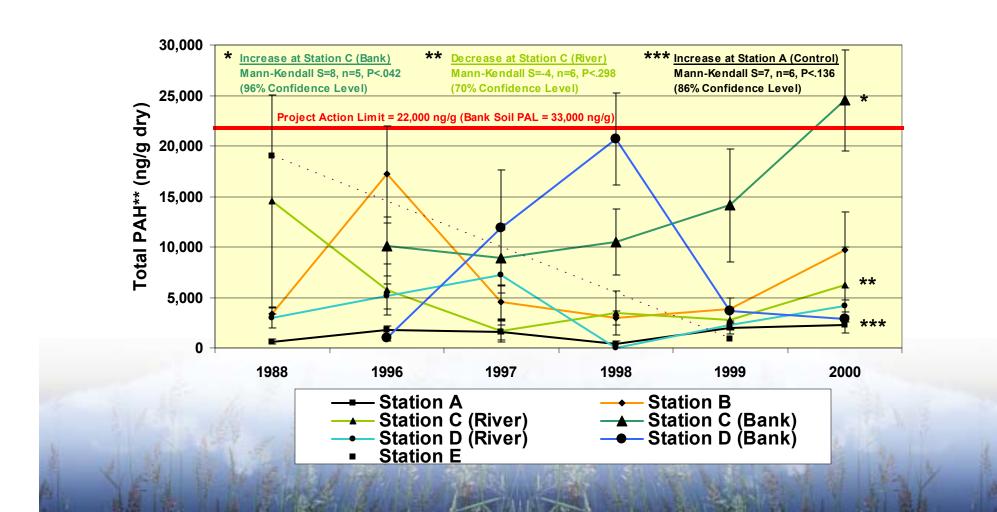


Mean Arsenic in Sediment and River Bank Soil, 1988-2000





Mean Total PAH in Sediment and River Bank Soil, 1988-2000





Overall Trends in Sediment and River Bank Soil Contamination 1988-2000

Station	Station Description	Arsenic	Total DDT	Total Chlordane	Total PAH
Station A	Control	No Trend	No Trend	No Trend	↑
Station E	Adjacent to the Site	No Trend	No Trend	No Trend	No Trend
Station B	Between Union and Center Streets	No Trend	↓	No Trend	No Trend
Station C	Ice Pond, River	↓	\	\downarrow	1
Station C	Ice Pond, Bank	No Trend	No Trend	\	1
Station D	Mary Lee Wetlands, River	No Trend	No Trend	No Trend	No Trend
Station D	Mary Lee Wetlands, Bank	\	No Trend	\	No Trend

Apparent trends in 1988-2000 sediment concentrations were estimated using Mann-Kendall test (Gilbert, 1987)



Summary - Sediment and River Bank Soil Monitoring

- Concentrations Were Below Media-Specific PALs
- Single Year Peak in Concentrations 1-3 Years After Remediation, but Overall Downward Trends from 1988 to 2000, Except for Total PAH
- Upward Trend in Total PAH in Sediment at Station A (Upstream) and in River Bank Soil at Station C
- Grain Particle-Bound Contaminants



Summary – Fish Monitoring

- In 1999, Concentrations in Fish Were Below Chemical-Specific Project Action Limits (PALs)
- B(a)P and Total DDT in Large Bullhead from Sylvan Lake Approached PALs, and Fish Upstream of the Site had Higher Total PAH Compared to Others
- A Year After Remediation (in 1996), Concentrations in Fish had Increased
- Within 4-Years Post-Remediation, Concentrations in Fish had Decreased Significantly to Below PALs



Conclusions

Remediation of Contaminated Sediment Was Effective in Significantly Reducing Concentrations in Fish and Risks Within 4-Years

Site Remediation Fostered Downward Trends in Contamination of Sediment and River Bank Soil Within 4-Years, with Exception of Total PAH

